

“Experimental Researches on the Variations of the Volume of the Brain and Skull”

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In looking at this splendid 1876 Parisian scene painted by Renoir (“Dance at Le Moulin de la Galette”), one would be interested to know that whereas the average skull capacity of male Parisians ranks among the largest skulls known, the average skull capacity of female Parisians ranks among the smallest female skulls observed.

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Messieurs, I have the honor of delivering to you several conclusions that appear in a work on the variations of the volume of the brain and skull¹ that I shall soon be submitting to the Society.

These conclusions are based on a considerable number of measurements that I have executed upon live subjects or upon skulls belonging to the Society's Museum, and also from unpublished records whose access I owe to the graciousness of Doctor Broca. The data have been expressed in the form of line graphs which, as some of you know, have been displayed in the anthropological sciences section at the Universal Exposition.

1. The variations of the volume of the skull in the human species are greater and much more apparent than those differences that are visible when one restricts himself to a comparison of averages. Within the same race these variations are very considerable. For example, by weighing 100 Parisian skulls belonging to the male sex, it will be seen that their weight will vary between 1,000 and 1,700 grams. The capacity of an equal number of skulls of the same sex will show that the volume of these skulls ranges between 1,300 and 1,900 cubic centimeters. These extreme amounts are linked to each other in a progressive manner. In mixing together all the races and both sexes, one will recognize that the capacity of the human skull may normally vary nearly 100%, that is, from a simple, small size to one almost twice as large. Many factors, of which the principal one is the level of intelligence, determine these variations or their correlates.

2. The average skull capacity of the superior races considerably surpass that of the inferior races, but **what really constitutes the superiority of one race over another is that the superior race contains many more voluminous skulls than the inferior race.** For every 100 modern Parisian skulls examined, there are generally 11 subjects whose skull capacity falls between 1,700 and 1,900 cubic centimeters, whereas in the same number of Negroes one does not find any whose skull possesses the previously-indicated capacities. In the very inferior races, the most voluminous skulls hardly ever exceed 1,500 cubic centimeters. Comparing the largest skulls belonging to the superior races to the largest skulls of the inferior races, the difference amounts to the enormous number of 400 cubic centimeters. By contrast, the difference between the average capacity of skulls belonging to these respective races is only a little over 200 cubic centimeters.

3. The aforementioned considerable differences of the brain weight or skull volume between individuals of the same race vary substantially from one race to another. These differences become greater and greater as the race rises up the

ladder of civilization, constantly increasing in the same race in proportion as it becomes civilized. By grouping the volumes of the skulls of each race in a progressive series, taking care to only establish comparisons on sufficiently numerous series in order that the extreme terms are connected in a gradual fashion, one will discover that the difference between the volumes of the largest and smallest adult male skulls is: in the gorilla, 148 cubic centimeters; in Australian aborigines, 307 cubic centimeters; in the ancient Egyptians, 353 cubic centimeters; in 12th Century Parisians, 472 cubic centimeters; in present-day Parisians, 593 cubic centimeters. Additionally, in Germans today, this difference happens to be more than 700 cubic centimeters. The inequalities of skull capacity—hence, of intelligence, that exist in mankind therefore tend to constantly increase.

4. Height exerts an influence upon the volume of the skull and the weight of the brain, but this influence is minimal. By assembling into groups all individuals of the same height and obtaining the average weight of the brain of each group, one will discover that the average brain weight between the tallest and shortest group of individuals rarely attains a difference of 100 grams, whereas the difference in brain weight often amounts to 300 grams among individuals of the same height.

5. One's sex imparts a substantial influence upon the weight of the brain. A woman possesses a brain that is considerably less heavy than that of a man, *and this inferiority subsists when both are of equal age, height and weight.* Various studies of female brains show that in the most civilized races, such as contemporary Parisians, there is a notable proportion of the female population whose skulls by their volume come nearer to those of the gorillas than to the most developed male skulls. In a general way the brain of a civilized woman much more resembles that of a man belonging to an inferior race than that of a civilized man.

6. The difference existing between the brain weight, and by consequence the skull volume, of a man and woman progressively increases as a people's level of civilization rises; so, *from the point of view of the mass of the brain and therefore of intelligence, the female tends to become more and more differentiated from the male.* The difference that exists, for example, between the average skull volume of contemporary Parisian males and females is nearly double that which exists between males and females of inferior races or of certain vanished races, like the inhabitants of ancient Egypt.

7. Female skulls of superior races, where the role of women is of little account, are remarkably smaller than female skulls belonging to a great number of inferior races. Whereas the average skull capacity of male Parisians ranks among the largest skulls known, the average skull capacity of female Parisians ranks among the smallest female skulls observed, barely exceeding the skull capacity of the women of New Caledonia.

8. With respect to subjects possessing the same skull circumference but who might present differences in skull volume upwards of 200 cubic centimeters, this is easily understood when one recalls that several factors, notably the height of the skull, may account for the variation of the volume for a given circumference. Hence, when one works on a series of skulls, one soon realizes that a 1 centimeter increase in the total circumference of the skull corresponds to an expansion of the volume that fluctuates over a 100 cubic centimeter range. The known properties of spherical bodies immediately suggest that as the circumference is increased by 1 centimeter upon a small head or upon a large head, the respective increase in the volume must be a little less or somewhat greater to that which I have just indicated.

9. The comparative study of the graphs of the skull circumference with that of the head, as well as with the skull volume and brain weight, has made evident the relations existing between these different quantities and has rendered possible the construction of tables that, just by containing one of these known quantities, permits one to immediately determine the others whenever one operates upon a series. For example, one sees that among modern Parisians a head whose circumference is 57 centimeters corresponds to a skull whose circumference is 52 centimeters and volume is 1550 cubic centimeters. The weight of the brain contained in this skull will likely be 1350 grams.

10. There is invariably an unevenness in the development of the two halves of the brain, which is sometimes more developed on the right side, sometimes on the left, without one's level of intelligence or race seeming to have any apparent influence upon the direction of this unevenness in development. However, this uneven development does not manifest itself in the same way in each of the parts of the skull.

11. The differences in skull capacity that one observes among the diverse categories of individuals of the same race do not appear to be attributable to causes other than the level of intelligence, in view of the fact that when these categories are sufficiently well-represented, they each obviously include just as many individuals of the same height and weight. With measurements effectuated upon 1200 heads of living Parisians, I have offered proof that from the point of view of the volume of their heads they rank, from largest to smallest, in the following order: 1) *scientists and men of letters*, 2) *middle class Parisians*, 3) *nobles of ancient families*, 4) *domestics*, 5) *peasants*.

FOOTNOTE

1. *Recherches anatomiques et mathématiques sur les lois de la variation et de la forme du cerveau et du crâne dans l'espèce humaine et sur leurs relations avec l'état des sentiments et de l'intelligence*. Main part: VARIATIONS OF THE VOLUME. 8 pages, out of 80 total pages containing 10 plates and 14 tables (Extract from the *Revue d'Anthropologie*).